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ABSTRACT

Enhancing the awareness of (1) the organization of "typical" computer projects, (2) the communication that emerges from those structures, and (3) the problems that technical communications inherently hold is the purpose of this paper. It begins by presenting the organization of the working group of a computer project (a college that is going to transfer student transcripts from a manual system to an automated system) and the roles played by these individuals. It then lists briefly the communication environments that might exist in such a project and specific communication difficulties that can and do arise in conveying technical information. The paper concludes by grouping suggestions for improving communication into three main areas: general suggestions, suggestions for the oral communication event, and organizational suggestions. (HOD)

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AN EXAMINATION OF JOB-SPECIFIC COMMUNICATION IN THE COMPUTER INDUSTRY

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I. INTRODUCTION

The astronomer Carl Sagan noted "We have a society which is built on science and technology and which uses science in every one of the interstices of national life, and in which the public, the executive, the legislative, and the judiciary have very little understanding of what science is about. That is a clear disaster signal. It has to be suicidal."[1] If this disparity in knowledge threatens to overwhelm the non-scientist, how much more frightened we should be when we realize that even within the high technology fields the effective dissemination of information can be strained or even absent.

The purpose of this paper is not to frighten or alarm, although some alarming information may emerge. Rather, it is hoped that this presentation can enhance awareness of some of the structures and organizational problems which exist within a segment of the computer industry. That portion of the business which is addressed here is the small to medium scale project whose object is to develop computer software or integrate software with hardware. Such projects may range in size from one to more than thirty participants at multiple levels an in various communication environments.

This discussion proceeds in four areas. First, a typical project organization will be presented. Individuals who might comprise a working group and the roles played by these individuals will be discussed. Second, a brief listing of communication environments which might exist in such a project will be presented. Third, specific

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[1] Howard Rheingold and Howard Levine, Talking Tech, William Morrow and Company, New York, 1970, p. 8

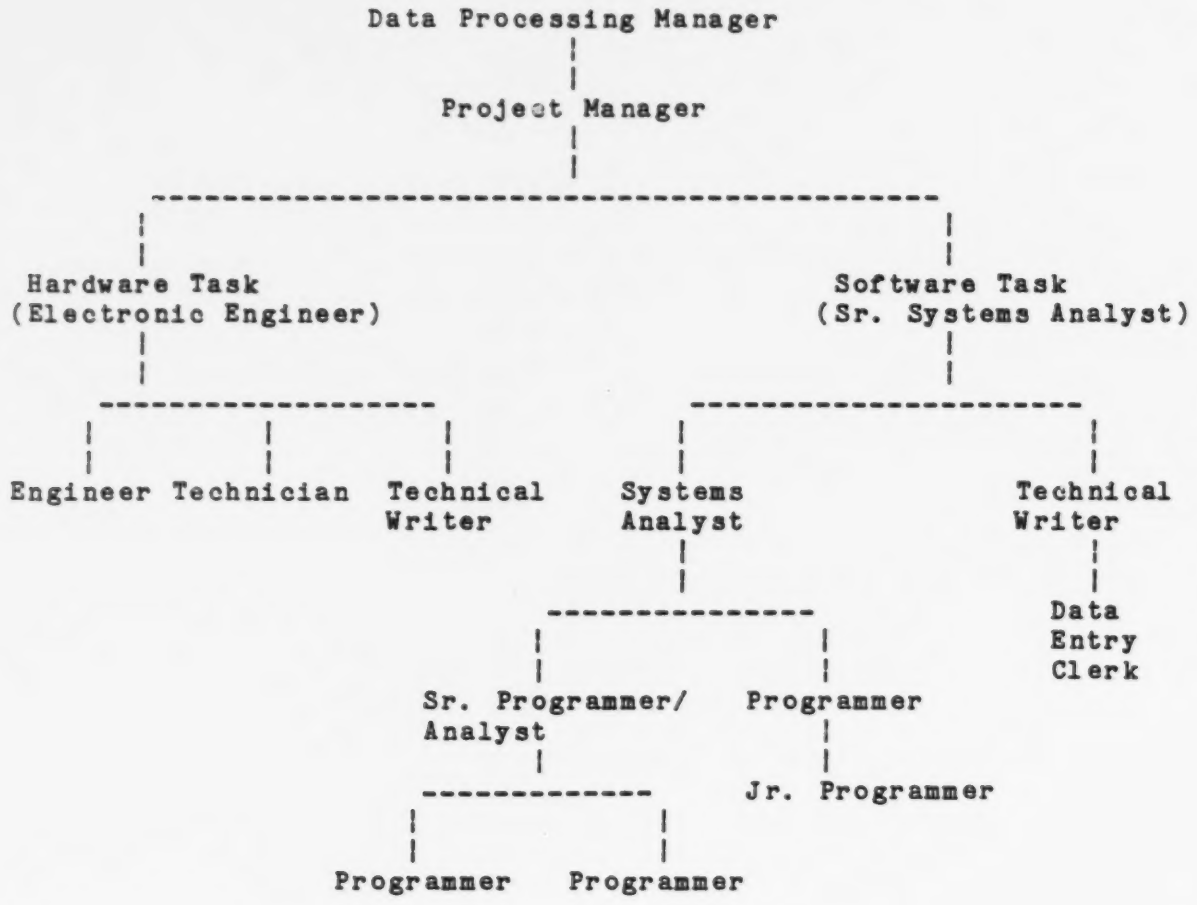
communication difficulties that can and do arise will be detailed. Fourth, and finally, some potential remedies for these difficulties will be outlined.

As with any small presentation which is biting off a large chunk of the communication loaf, several caveats are warranted. The discussion here will deal with a "typical" project and, of course, there is no such animal. Each project is individual and the problems and difficulties encountered will likewise be unique. The current presentation will, of necessity, oversimplify much. Alas, it is impossible in a few short pages to deal with even a small portion of an industry in more than a cursory manner. It is also true that the problems outlined here, while valid for a large number of computer software projects, may not be accurate for other technological areas or even for more divergent sorts of computer projects.

II. THE ORGANIZATION OF A COMPUTER PROJECT

The Development Staff. The hierarchy of a data processing project does not appear to be different from any traditional subordinate-superior structure. Indeed, the lines of authority are usually clearly defined and information moves from lower to higher organizational levels while authority traverses the opposite route. For purposes of illustration this paper postulates a college which is going to transfer student transcripts from a manual to an automated system. At the same time, the college is electing to install a Local Area Network (or LAN) which permits any terminal connected to the system to communicate with any computer also attached to the LAN. Because there are both hardware (equipment) and software (program) components to the project, two task

areas are defined. The organizational chart might look something like this:

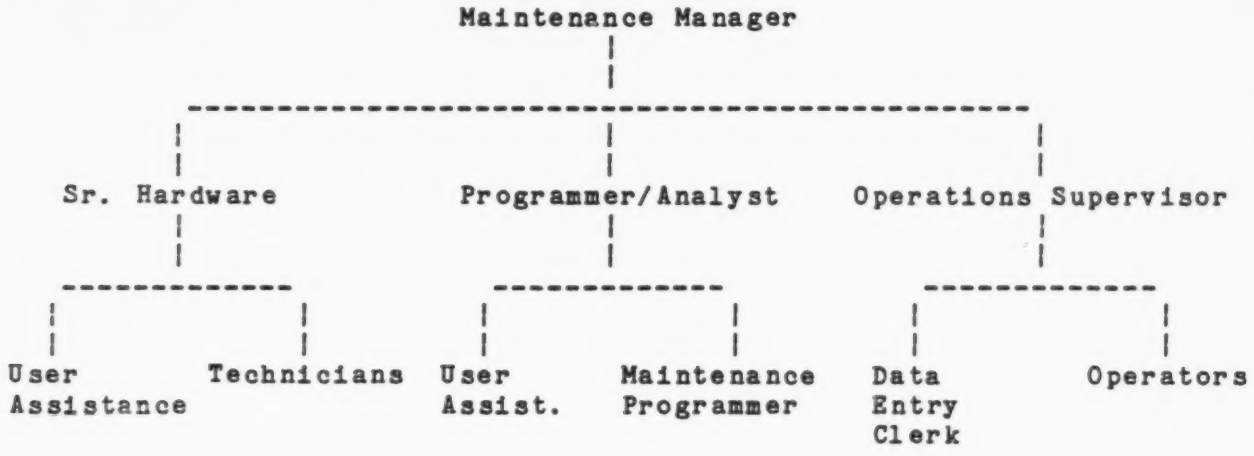


Computer System Users

The organizational scheme outlined here represents only those individuals who will work on developing the records system. It is likely that all of these persons would be employees of the college and would come from the general pool of data processing staff members. It is not clear that these persons would have worked together or in this particular organizational configuration before. Organizational

structures are usually built after an initial analysis of the situation and are unique to each project.

The Maintenance Staff. A further complication is that these same persons will not necessarily provide on-going support to the users of the system once it is completed. It is common for the development staff to move on to other projects once they are finished and for a separate maintenance staff to handle fielding user problems and resolving complaints. Maintenance, sad to say, has a poor reputation and is one of the least glamorous of the data processing functions. The college for whom the records system is being built might install a maintenance organization along these lines:



System Users

Who, then are these nameless data processing professionals staffing the records project? What do they do? The organizational charts indicate five classes of persons involved in the overall effort. A brief discussion of each class is in order.

Management Staff. These persons formulate overall strategy and direction for the project. They make decisions. They manage. The

Data Processing (DP) Manager likely heads the computer center at our college. He or she does not have much involvement in the day to day operation of the project since this person supervises all DP activities. The Data Processing Manager will retain ultimate authority for all work. Most operational authority is delegated to the Project Manager, a person who remains with the project and its difficulties.

Hardware Staff. These persons would be drawn from the pool of talent within the computer center with some assistance from the Electrical Engineering Department. They are charged with selecting, installing and maintaining the hardware (cable, telephone lines, modems, multiplexers and computers) which form our LAN and records system. The Electronics Engineer (EE) performs design work and directs the installation and supervises technicians. The Technicians perform "hands-on" installation and track and resolve system difficulties.

Software Staff. Generally thought of as the persons who design and "program" the system, there are several job titles contained in this category. Systems Analysts have more interaction with the users than other persons. They will meet with the records staff and endeavor to fully understand the operation of the Records Office. They will decide how much storage space is needed by the system, they will design the way information is entered into the system and the reports which will come from the system. They select the way a terminal screen looks when asking for data as well as the number and type of modules (programs) which will be required. To a large extent, the analyst is the key to successful project communication.

Programmers actually implement the system based on the specifications drawn up by the analysts. They handle the bulk of the

coding (writing programs) and testing for the system. Finally, Programmer/Analysts, as the name implies, operate in between the realm of the analyst and that of the programmer. They may have responsibilities involving user interaction and may supervise programmers or program themselves. For very small projects, a programmer/analyst may be the only staff member assigned.

The Support Staff. These individuals fill the gap between the users and the technical staff. Technical Writers will work with programmers, engineers and analysts to produce system documentation (user manuals, system manuals and maintenance manuals). On occasion they may also serve as trainers, teaching the users how to operate the finished system. Technical Writers may assist with the testing or quality assurance (QA) for the total system or various subsets.

User Assistance staff members field user problems or questions, answer them if possible and pass them along to hardware or software technical representatives if they cannot. Data Entry Clerks are low level technical staff members who enter data into the system. They may also assist with reports and preparation of written materials. Finally, operators make sure that printers are supplied with paper, mount tapes on the computer when requested to do so and schedule maintenance calls to keep the hardware operating.

Users. Included last because they are often seen in that light by the development staff, users are those persons for whom the system is designed and who will operate and own it once it is "on-line". The low

status often attributed to users can result in significant communication difficulties.

III. COMMUNICATION WITHIN THE PROJECT

It should be apparent by this point that a number of communication channels exist in even a small development project. This discussion cannot examine all of the possible levels of communication but will attempt to outline the major interactions which are likely to occur between various groups involved in the records project.

Hierarchical Communication. As previously mentioned, the authority/reporting functions implicit in any hierarchical organization occur. Subordinates report to managers. Status meetings are held to report on work scheduled or completed. Design specifications for the system are reviewed and approved.

User - Management Communication. Most projects are initiated when the user senses a need for a computerized service or function. The desire for this service will be communicated to the DP Manager. The Data Processing Manager, if the project is seen as viable, will assign a Project Manager. The Project Manager will meet with users in an effort to determine the scope of the project and will develop an organizational approach. Requests for approval of resource allocation (funding), reports on project progress and requests for modification of the project will all occur at this level.

Management - Technical Staff Communication. Managers must pass resource limitations and top-level plans to the technical staff for implementation. Requests for additional staffing, progress reports and

milestone dates move from Technical Staff to Management. Analysts and lead engineers again occupy a position of primary importance.

Technical Staff - User Communication. Although frequent contact takes place at this level as the analysts attempt to understand the needs of the user and define project requirements, very little decision making authority is usually present here. Rather, major decisions must be handled at the managerial level. While some contact between users and lower level technical staff members may take place, such interaction is not commonplace. The importance of this level of communication should not be underestimated. It is at this level that the information required for a successful project will be generated. As Perry indicates:

> All aspects of thinking and understanding--in the human sense of these terms--must have been analyzed logically and expressed with precision as either machine instructions or in a form (FORTRAN, ALGOL, COBOL, etc.) which may be transformed into a corresponding sequence of precise machine instructions, that is to say, into an operational computer program.[2]

Thus, the communication between the users and the technical staff has as its goal the translation of the needs of the user into design specifications and, hence, lines of computer code (programs) which will satisfy those needs in the most effective and efficient manner.

Internal Technical Staff Communication. Not only must the analysts translate the needs of the user into specific requirements which the programmer can implement, but there is a need for the hardware staff to coordinate with the software group. It may also be

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[2] James W. Perry, "Communications and the Scientific Method", in Herman M. Weisman, ed., Proceedings of the 1965 Institute in Technical and Industrial Communication, Institute in Technical and Industrial Communications, Ft. Collins, Colo., 1966, p. 119

necessary for technical staff members to seek outside expertise in order to achieve some system goals. Programmers and analysts will frequently exchange ideas with one another in an effort to find the optimum approach to a problem.

Technical Staff - Support Staff Communication. It is not enough to design an effective an appropriate program. The analysts and programmers must disseminate information to technical writers to ensure that they understand the user needs and the program operation. Without this knowledge the instruction manuals on system use may not be adequate for user needs. Technical writers must also prepare documentation adequate to permit the maintenance staff to carry out their duties. Data entry clerks must understand what format the computer uses in order to enter material in correct form and sequence. Operators need to know when they will be required to perform specific tasks.

Inter-Organizational Communication. As if there were not enough communication channels involved, many colleges do not have adequate staff members available for a development project of this size. Thus, implementation may require obtaining a contract with a data processing consulting firm for additional staff. In such a case there is additional management (contract project manager and marketing staff) and contractor analysts, programmers and/or engineers integrated into the organizational chart slots. These individuals may have no knowledge of the college or its requirements and may be used to different approaches to hardware or software development. "There are

... many differences between scientists and technologist, and these differences influence greatly their patterns of communication".[3]

IV. AN OVERVIEW OF DIFFICULTIES IN TECHNICAL COMMUNICATION

The Nature of Technical Communication. Even if the organizational structure of a computer project were not complex, the communication of technical material - especially when the audience is not technical - can present great difficulties. There seem to be essential elements in technical communication which account for its complexity. Four examples of these elements should make the point clear.

First, technical communication generally consists of new ideas. In a computer project, a new system is being built or modified. This means that all of the project participants may make only limited use of prior experience. The non-technical user is being thrown into an arena which is not familiar and which may be perceived as hostile.

Second, technical communication usually consists of a large number of variables. It is not enough to understand only one portion of the program, network, computer or user operation. The entire approach to problem solving, filing, arrangement of staff, and the like must be known if the computer system is to perform as desired. There are multiple programs and variables within programs which must be considered. Hardware components can frequently be installed and configured in many patterns. Each element of the system exerts a synergistic influence on all others.

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[3] Thomas J. Allen, "Roles in Technical Communication Networks", in Carnot E. Nelson and Donald K. Pollock, ed., Communication Among Scientists and Engineers, Heath Lexington Books, Lexington, Mass., 1982, p. 191

Third, the relationships among these variables are complex. To the user or our records system, it may not seem like a great difficulty to add a line to a printed transcript which contains the home town of the student. After all, it could be added with a typewriter in a few seconds. But if that information is contained in a storage location (file) which is not being used by the transcript report program, such an addition may involve a major reprogramming effort and delay project conclusion. Complexity exists within the technical staff arena as well. If the software developers do not realize that changes they make can have an impact on the hardware development (or vice versa), an endless series of crises can occur.

Fourth, technical communication, more than other types, must adapt to the audience. The range of receivers varies from those with a complex understanding of electronic theory to total novices. It is exceedingly difficulty to strike the correct balance of complexity and simplicity in presenting technical material.

If there are inherent difficulties in the presentation of technical information, how good a job do computer professionals in overcoming these barriers? Given the limitations, most practitioners do a credible job. This is not to say that communication barriers do not exist - for they do. And they frequently exist at every level. The current section of this paper outlines four major categories of communication difficulties.

General Communication Problems. Many of the notions presented here are not unique to the computer world. They do, however, have a major impact on the ability to effectively communicate, and hence perform work, in the high tech environment. It is unfortunate that the

vast majority of computer professionals are not trained to be communicators. Often there is little or no formal training in public presentation, much less interviewing or interpersonal techniques.

> Few engineers, scientists, managers, and other professionals faced with the requirement to present a technical briefing, explain an engineering proposal, describe a scientific breakthrough, or outline a management plan can draw upon formal training for the techniques needed to communicate effectively when face to face with an audience. Some individuals can prepare highly polished written material, but cannot cope with the requirements of the real-time communication imposed by technical presentations.[4]

Indeed, in researching material for this paper it became evident that little real effort is made to stress the importance of oral communication to technical staff. An examination of two currently used systems analysis texts revealed that one failed to mention oral communication skills at all[5] while a second devoted only 2 1/2 pages out of a twelve page communication chapter to oral skills[6]. The remainder of the chapter was devoted to written report preparation. Such is the training which is given to the most critical group in the project communication chain.

Nor is this an isolated instance. In a survey of several national and international symposiums on technological communication, only four out of some thirty authors had a degree in a communication-related field and none were academic practitioners of speech or oral

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[4] Robert M. Woelfle, A Guide for Better Technical Presentations, Institute of Electrical and Electronics Engineers, New York, 1975, p. 1

[5] Robert J. Thierauf and George W. Reynolds, Systems Analysis and Design: A Case Study Approach, Charles E. Merrill Publishing Company, Columbus, 1980

[6] Marvin Gore and John Stubbe, Elements of Systems Analysis, 3rd Edition, William C. Brown, Co., Dubuque, 1983

communication. It is clear that instruction in technical communication has fallen heavily on the shoulders of the instructors of English composition and has avoided involvement with speech communication.

A second general problem is the fact that computer workers and engineers frequently fail to choose the optimum communication medium for important ideas. Francis W. Wolek, in his study of technical communication, noted that in "72 percent of incidents of gathering information for use in solving problems, scientists used written ... means".[7] Yet the appropriateness of such information gathering in the computer setting is doubtful[8]. Even when an oral medium is used, it is more likely to be a formal presentation or public address than an informal discussion, presentation or interview.

Perhaps one of the most contemporary illustrations of an inappropriate communication medium is that of electronic mail. As more and more workers within the computer industry as well as casual users, have access to electronic mail systems, interpersonal communication diminishes. Along with this decline go the nonverbal cues which are so important to the extraction of meaning from a communication event.

Nor are those who should be aware of these difficulties immune. In preparing for this presentation, I sent a message to colleagues of mine asking for their perception of communication problems. In order

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[7] Francis W. Wolek, "The Complexity of Messages in Science and Engineering: An Influence on Patterns of Communication", in Communication Among Scientists and Engineers, Heath Lexington Books, Lexington, Mass., 1970, p. 240

[8] Ibid., p. 237

to reach a large audience in a brief period of time, electronic mail was used. The following message was sent:

> I am going to be presenting a paper at a communication convention in Providence in May and would appreciate any assistance you could provide me. I will be taking about communication problems in the computer environment. If there are instances you have encountered of problems in communicating with other groups or individuals I hope you will send them along to me so that I can include them in my discussion.

Of course, what I forgot to mention was the fact that this was a speech communication convention - not a data communication convention. Thus, the reply I received:

> In my opinion, one of the biggest problems in electronic communications is the difficulty of interfacing various types of equipment. While the U.S. is slowly swinging towards international standards, i.e. PAD X.25, X.21, etc., we are still faced with the problems of interfacing different protocols.
>
> With standardization it would make everyone's job a little easier. Users would be at least familiar with the way in which their equipment functions.
>
> Another item that I feel would be of great value is teleconferencing. This could be one of the greatest tools for use in any organization for obvious reasons. If you would like to discuss this further, feel free to give me a call.

Another of the general communication difficulties one regularly encounters in the computer field is that of jargon. Acronyms are rampant in the computer trade. Companies do not seem able to exist unless they have a three letter acronym for a name (MCI, IBM, ASG, etc.). At the same time, the software and hardware which is developed is replete with an alphabet soup that few bureaucrats could decipher. Witness a job advertisement which appeared in the Washington Post:

> . . . one of the nation's top twenty professional service firms, is proud of its reputation for excellence spanning a thirty-six year history. . . .
>
> As a result of our continuing growth, we offer immediate opportunities for Senior Analysts, Programmer/Analysts, Programmers with at least 3 years solid DP experience including: COBOL, PL/1, ALC, BASIC, IBM, Honeywell, Univac, IMA, ADABAS, NATURAL, TIP, DM-IV, DMS-1100, M-204, UNIX-C, MULTICS, CICS, MICROS/PC's, MUMPS ... [9]

As many problems as acronyms cause alone, they can be doubly problematic when found in a military environment as the following typical memo excerpt illustrates:

> Ref: (a) Contract No. N99999-99-C-9999
> (b) Dir DONALD PM ltr 23 Mar 99 to DNL subj: Laboratory Computer Network (NALCON) DONADPM Control #23
>
> 1. Maintenance has been provided for the Base NALCON computer systems under reference(a). Due to various factors DEC will no longer supply maintenance under reference(a). ADPSO issued a Delivery Order against DEC's GSA contract for FY99 a copy of which is provided in enclosure(1). . . .

A final general concern is that of security. Both industrial security and the variety imposed for national security reasons can limit the transmission of information in any high technology environment. It is quite possible to believe that one has all of the relevant data only to discover at a later date that this is not the case.

Communication Difficulties for Technical Staff. In addition to the more general problems which have been outlined, technical staff members encounter a number of unique difficulties in the attempt to convey technical information - especially when the audience consists of

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[9] The Washington Post, April 28, 1985 (vol. 180, no. 144), p. L11, col. 4

users or other non-technical individuals. Two classes of problems are worthy of mention here.

First, technically oriented persons seem to have significant problems in translating technical material into information suitable for a lay audience. The importance of such a translation was noted by Allan S. Udler in Government Executive:

> Users frequently don't know a bit from a byte. Often they don't even have a solid knowledge of their system fundamentals. Knowing what questions to ask in defining system needs is as important or more so than consideration of hardware/software performance specifications.[10]

This translation difficulty seems to have several causes. For one thing, most computer scientists and engineers are trained in the rigors of scientific methodology. For them, technical questions have definite answers - firm solutions. They are, at times, unable to understand why users, presented with the same information available to them, are unable to reach the same conclusions. It is also true that working with machines and not people on a daily basis dulls communication skills and results in awkward or ineffective communication when the situation dictates that such contact must be made.

It is also quite common to find the computer scientist or engineer who attempts to adapt to the audience by oversimplifying information. The notion that "users are stupid and not to be trusted with important information" is all too prevalent among the professionals who develop computer systems. Perhaps this attitude is enhanced by the fact that

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[10] Allan S. Udler, "The Hazards of Office Automation," Government Executive, v. 16, no. 6, 1981

technical sorts often want to present theory and not the practical techniques which would be of more use to users.

An additional problem confronting technicians when they present complex information is a tendency to think of a computer or other system as belonging to them and not to the user. They do not want the user to "mess up" or interfere with their creation. This can result in material being withheld from users "until the appropriate time." Such a practice is so pervasive that a popular computer publication depicted a programmer standing in front of a detailed system flow chart and holding a submachine gun. The body of a poor user was sprawled on the floor, riddled with bullet holds. The programmer was asking if any other user had a comment on the proposed system design.

Perhaps the sad conclusion regarding the ineffectiveness of oral communication for many technicians was presented by Thomas J. Allen in his paper, "Roles in Technical Communication Networks":

> . . . the average technologist cannot communicate effectively with outsiders. This is reflected in the results of several research studies which are consistent in their discovery of an inverse relation between outside personal contact and technical performance.[11]

Communication Difficulties for Non-Technical Participants. All of the communication problems should not be laid at the feet of the technical staff. Users and other non-technical participants (including some managers) must accept their share of the responsibility when communication channels break down. Three types of problems illustrate the difficulties that can emerge on the user/non-technical side.

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[11] Allen, op. cit., pp. 191-192

First, it is true that many users experience a certain phobia when it comes to computers. This is especially true of older, more established employees who may feel that their job is threatened by automation or who may be wedded to an established method of operation. These persons may intentionally or unintentionally delay or disrupt a project with faulty or incomplete information.

Second, Users have a limited amount of time available to devote to an understanding of computers or computer systems[12]. This is understandable since working with an analyst to develop a computer system is a time consuming activity. In our earlier example, the records administrator is busy sending out transcripts, handling record updates and running his or her department. Such a situation can result in incomplete information and the need for still more interviews.

Third, significant differences in perceptions can exist. For the user, the only knowledge he or she may have about the computer system is how the screens appear on the terminal, the type of information demanded by the computer, and the format of reports that emerge from the printer. The systems person may have more detailed information about the LAN, the computer system and the applications program handling that which the user sees. This can be a most vexing problem when the user must report a difficulty to the user assistance group in a maintenance organization. A user may not know that there are four different computer systems which can be accessed via the terminal. Thus, when the user assistance staff member asks what machine the problem is with, the user may perceive this as a foolish question.

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[12] Weisman, op. cit., p. 55

Likewise, different users of a computer system may operate at different levels or interact with different parts of the operating system. A phone call to a technical representative saying that the electronic mail system does not work fails to inform the technical representative if it is a problem with the user not knowing the proper commands, a hardware difficulty, a software difficulty, or some combination. Customer support functions demand a skilled diplomat who is also technically knowledgable.

Internal Technical Staff Communication Difficulties. Just because two members of a technical staff are communicating does not imply that such communication is effective. A number of problems can emerge in this area as well. Again, four specific examples should illustrate the point made by Francis Wolek:

> ...if a scientist is given a message of low complexity ... he will have no difficulty interpreting the message; if it is of moderate complexity ... he will not only have difficulty, but will exhibit signs of frustration and confusion; and if the message is of sufficiently high complexity, he will not be able to interpret the message after presentation and may even refuse to try.[13]

First, technical staff members generally have become specialists in their portion of the computer trade. Technical writers do not program. Many COBOL programmers do not program in FORTRAN. Analysts may not know how to fill the role of operators. Engineers may know nothing of the software applications being prepared on the hardware they install. This specialization can result in communication problems. An illustration of such difficulty is the fact that specific terms have different meanings to workers in different technological areas. While these different connotations may be slight, they are

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[13] Wolek, op. cit., p. 235

enough to cause confusion. The word "simplex" is a good example. To the hardware specialist working with data communications, this term means a telephone or other line which "permits transmission of signals in either direction, but not in both simultaneously"[14]. To the computer software specialist, however, simplex means a "circuit permitting transmission in one specific direction only."[15]

Other examples of confusion caused by specialization can be found among programmers. A person who has spent many years designing COBOL programs might become easily confused in discussing system design with a practitioner of ADA - a new programming methodology with totally different approaches to data design and integration.

A second difficulty which exists when technicians talk is the limited interdisciplinary exchange of information. The distrust (often good-natured) between hardware people and software people is legend and can result in both sides blaming the other for problems which users may be experiencing. Cross training for computer scientists and engineers is not the norm.

A third problem which can occur exists between programmers who may know the same languages and be conversant with the same design methodologies. Programming tends to be an art as much as it is a science. Imagine the variety of stories which would result from an English class assigned to write a mystery and only provided with a list of characters, a starting location and an ending location which must be used. So it is with multiple programmers given the same design

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[14] James Martin, Telecommunications and the Computer, Prentice-Hall, Inc., Englewood Cliffs, 1976, p. 649

[15] Ibid.

specification; myriad programs would result. There is no set way of approaching a problem. Difficulties are encountered when one programmer must change, finish or maintain a program started by another.

Fourth, and finally, computer professionals are no more immune to turf-building than their counterparts in other professions. A former colleague who is employed in the data processing department of a large oil company relates one example. She is charged with maintaining a "data dictionary" for the company. This is a master listing of all of the "variables" used in all of the programs for the company. Such a dictionary ensures standardization across programs. Yet programmers often resist such standardization because they fear that if others understand their programs and variables that they will no longer be indispensable to the company.

It is apparent from this brief illustration that a computer development project holds the potential for numerous and significant communication barriers and difficulties. Some of these difficulties are caused by translating technical information to non-technical audiences. Others result from users who are not accustomed to the problem-solving approaches taken by the DP world. Yet others are caused by the interactions which exist among technical professionals. The question then arises, What can be done to minimize these communication difficulties?

V. METHODS TO IMPROVE COMMUNICATION IN THE COMPUTER ENVIRONMENT

A number of suggestions will be presented, each of which can help to alleviate some portion of the communication quagmire outlined above. No one suggestion will address all difficulties and some of the

difficulties may be beyond the scope of the ideas outlined here. Yet taken as a whole and with the active encouragement of management and the communication profession, these notions could go a long way toward repairing some of the damaged bridges which keep computer professionals from reaching themselves and the outside world. These suggestions are grouped in three main areas: general suggestions, suggestions for the oral communication event, and organizational suggestions.

General Suggestions. There are three ideas here. First, involve the academic speech communication community more heavily in the computer profession. A golden opportunity exists for members of academia to make contact with the technical world and to impart information of great value. To a large degree, the computer field needs to be made aware that specific communication assistance is desirable and available. Included in the recommendations of a national task force on technical communication was a listing of resource groups which should be tapped in order to address technical communication issues. While the group included psychologists, business administrators, librarians, foreign language specialists and linguists, it did not mention the speech communication professional[16]. In addition to training, the speech field could assist with more directed, in-depth research of the communication needs in the computer field. Wolek[17] and others have suggested that more research is needed in this area.

A second general suggestion is the inclusion of more humanists in the computer field. In my own case, the transition from speech

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[16] Weisman, op. cit., p. 57

[17] Wolek, op. cit., p. 262

instructor to computer professional was aided by a small company in Washington with something called the "Career Development Program." This program took persons from the humanities - notably former teachers - and hired them based on their performance in a class where basics of programming, world processing, and computer operations were taught. Those offered jobs were rotated through a number of tasks ranging from proposal writing to computer administration and programming in order to instill a good sense of what the industry encompasses. More companies should be encouraged to take a chance on persons with good communication skills who could help address pressing needs.

Third, all individuals should receive listening training. It is hardly coincidence that the speech profession and industry are placing renewed emphasis on listening skills. The ability to listen effectively could alleviate many of the difficulties outlined above and enhance the communication process, especially communication between technician and end user.

Suggestions for the Technical Communication Event. The computer environment does present opportunities for all manner of communication - public, group discussion, interpersonal. The suggestions contained here represent a approaches which could assist the technically oriented individual in preparing for these opportunities.

First, persons in the computer environment should develop better skills at selecting the appropriate medium for communication. Greater use should be made of oral communication at all levels. The ambiguities in written material - especially draft material - could be

avoided were more interpersonal avenues utilized. Nor is the traditional formal meeting necessarily the optimum approach.

> The importance of the flexibility of interpersonal communication, in content and format, is emphasized in the report of the Committee on Information in the Behavioral Sciences. That report notes that, "there is considerable evidence that informal links communicate much more than document references"...and emphasized three advantages of interpersonal communication: promptness, breadth of content, and adaptiveness. ...informal communication may be used to report all sorts of information that are usually contained in publications, but it may report much more, too, precisely because such communication is extremely flexible both in content and in level of generality.[18]

Second, the technical specialist should exercise much greater care in the preparation for the communication event. Among the items where such care would be a benefit are:

1. Performing better audience analysis. The specialist should assume an empathetic view of the audience and not see them as antagonistic. One implication of such a notion is seeing the system as belonging to the user and the computer professional as providing a service to that user.

2. Select a level of complexity appropriate to the audience. Where possible, separate presentations should be made to those with a technical understanding of the system and those who are lay persons in the area.

3. Make no assumptions regarding the persuasive impact of factual material. Draw conclusions for the audience and let them evaluate those conclusions in light of the facts presented.

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[18] Wolek, op. cit., p. 237

> One important consequence is to make communication among scientists more effective and also more concise. All the details of experimental results do not need to be recorded, transmitted and understood by those to whom the communication is directed. Instead of attempting to transmit his observational data, a scientist communicates his conclusions, that is to say, his evaluation of his observations from the point of view of generally accepted theory.[19]

4. Draw on the experience of the audience and relate the novel to that which is known. Even if a totally new system or concept is being expressed, there are analogies which can be used to express ideas. This is especially true when users are being given a first view of a computer system. At this level, all of the facts need not be known and subsequent presentations can correct for any oversimplification.

5. Ensure that terms and concepts have the same connotation for presenter and audience.

> Specialized terminology and symbols, if understood by the recipients, can expedite communication by achieving precision and sharp definition both as to general principles and specific details. But precise terminology must be used with precision. Otherwise, even experts will be confused.[20]

6. Use multi-media presentations when appropriate. Industry usually well understands that graphic presentations enhance the durability of messages. Often in informal presentations these tools are overlooked, however. Where appropriate, greater use should be made of multiple channels of information.

The third and final suggestion for the communication event is to avoid the use of formulas. In researching information for this presentation it became clear that most "experts" offer formulas for dynamic and effective presentation of material or the handling of

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[19] Perry, op. cit., p. 135

[20] Perry, op. cit., p. 121

interview situations. Computer specialists need to understand the valid concepts in which communication theory is grounded. They should avoid, however, approaches reminiscent of the elocutionary movement.

Organizational Suggestions. Two suggestions are offered here. First, all members of a project team from top management to users and maintenance personnel should be kept informed of project developments. It is often from lack of information that hostility and uncertainty emerges. Technical lunches, technical bulletins, user groups and seminars are all valid approaches to spreading information regarding the status of a given project.

Second, the informal exchange of information and ideas should be encouraged. Users who are knowledgable about a system should be encouraged to become "gatekeepers" and share the wealth with others. Studies indicate that this approach can be quite effective in the dissemination of technical information within an organization.[21]

Improving the communication of a project, like improving the communication of an individual, can only work if change is truly desired. Everyone associated with the computer profession should endeavor to instill a desire for effective and open communication in all levels of project organization. It is only with that encouragement that change can take place.

VI. CONCLUSION

The goal of this paper is to better acquaint the reader with the organization of "typical" computer projects, the communication which emerges from those structures and the problems which technical communication inherently holds. The problems are numerous and the

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[21] Allen, op. cit., p. 207

solutions slow in coming but there is a great deal of promise as more computer professionals move from "on the job training" backgrounds to academic instruction in their discipline. These persons are usually more attuned to the needs of the user and the intricacies of project management.

It is hoped that we can at least do a better job of suggesting approaches to technical communication than that offered by the book Tech Talk. In teaching readers how to communicate about digital computers one finds:

> Everyone has his favorite story about the computer run amok, making life miserable for us mere mortals. For example, there's the story about the vacationers who return to their unoccupied home to find a three thousand dollar utility bill. So many of these stories have made the rounds that Talking Tech suggests you turn the tables the next time the topic comes up and relate these "man bites computer" tales: . . .[22]

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[22] Rheingold and Levine, op. cit., p. 102

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